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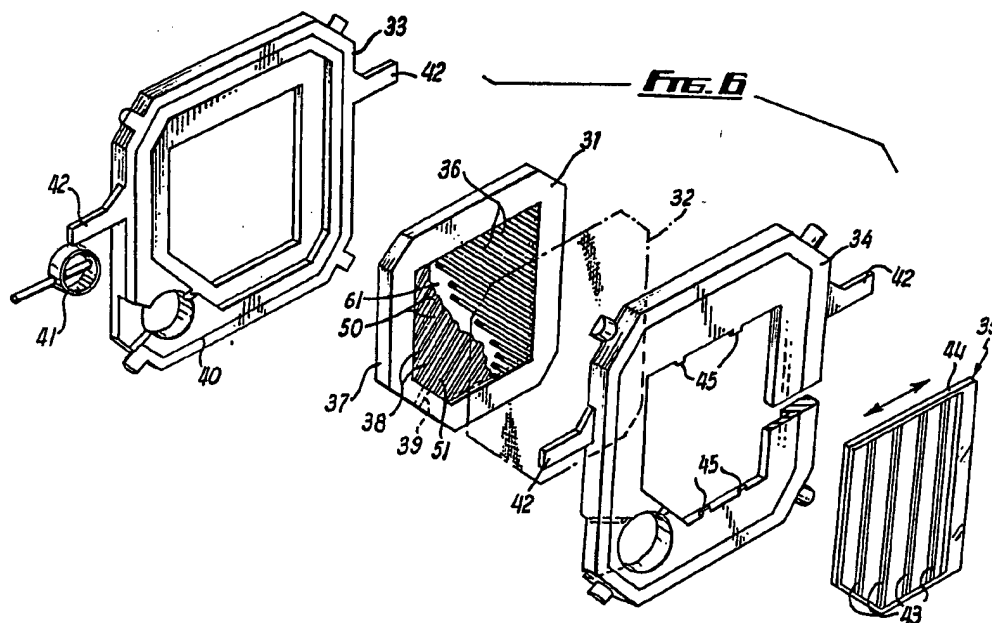
GB 0905088

(58) Field of search

B1D

(54) Filter press plate

(57) A filter press plate comprises two sets of parallel bars 36, 38 projecting from opposite sides of a central web 61, whose thickness is less than one third of that of the whole structure. The bars 36 and 38 can be orthogonal or parallel to each other, and the structure may support filter cloths 32 directly or inflatable membranes. The structure can be moulded in two pieces and removably located in a two-part frame 33, 34. The frame can include a laterally slidable multi-wire or multi-blade scraper 35, linked to the plate-spreading mechanism.



The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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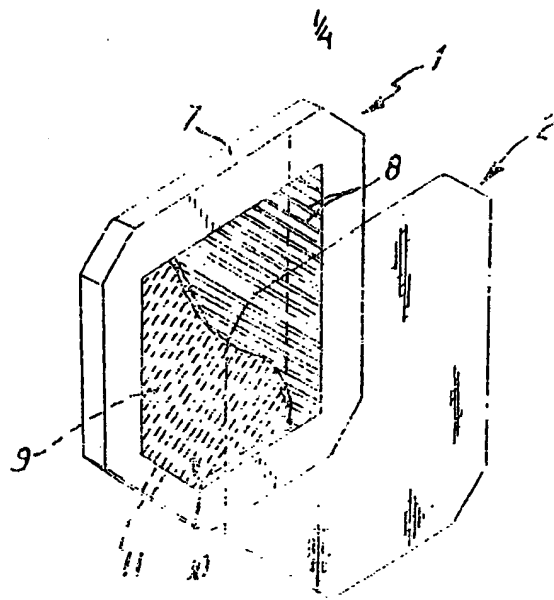


FIG. 1

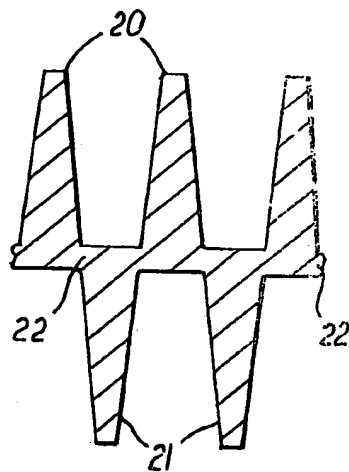


FIG. 4

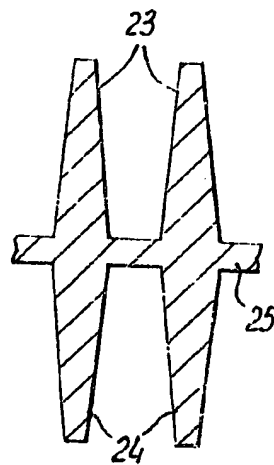
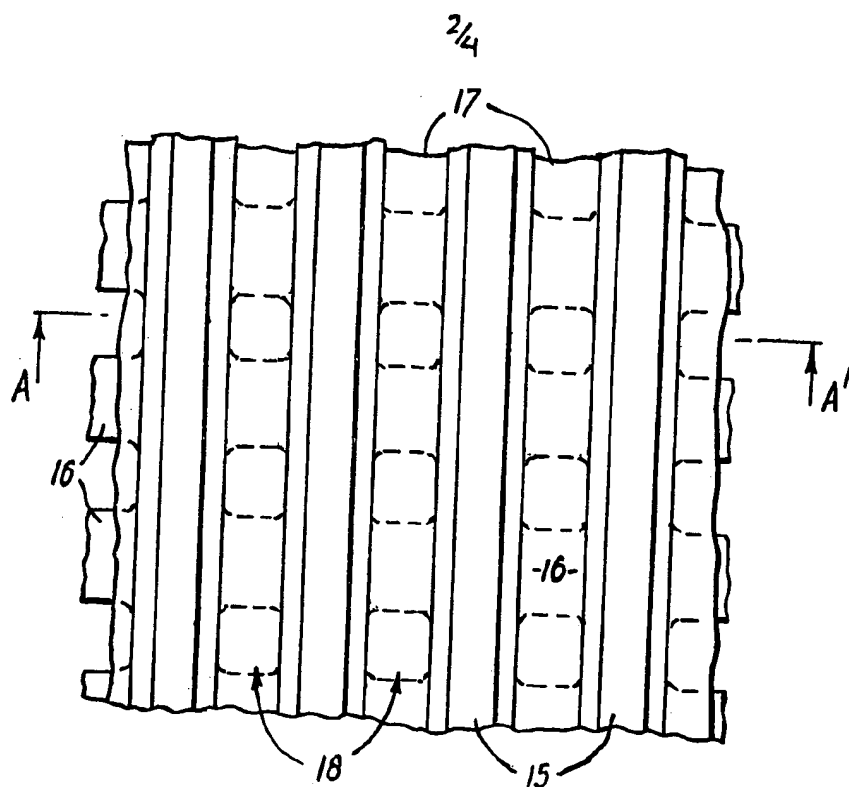
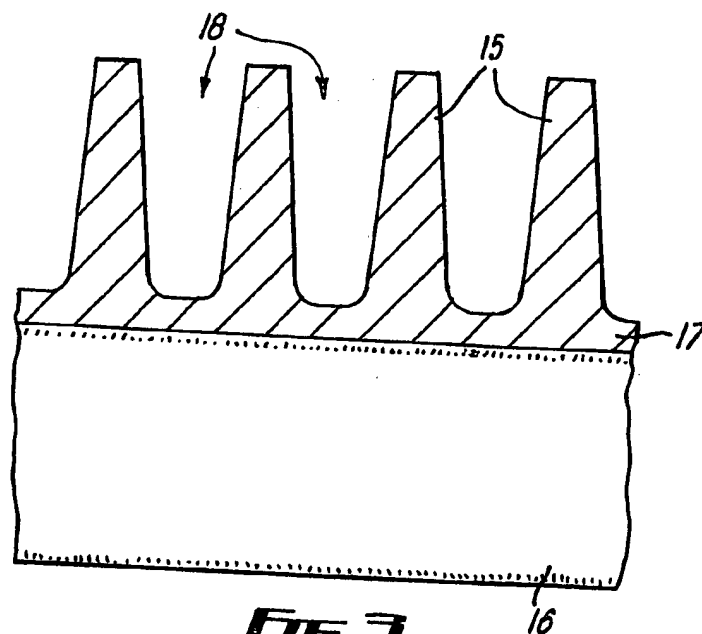


FIG. 5

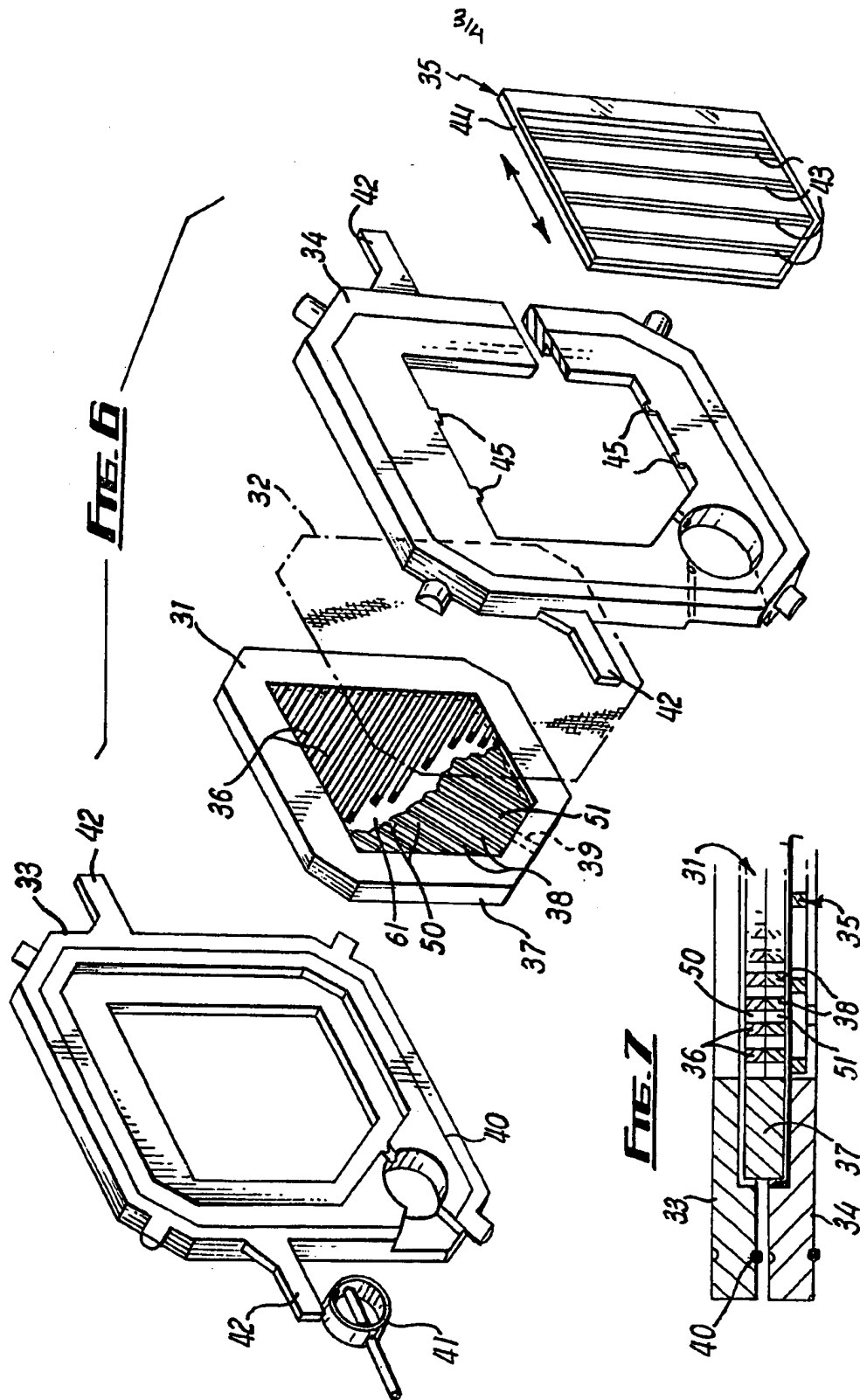


**Fig. 2**

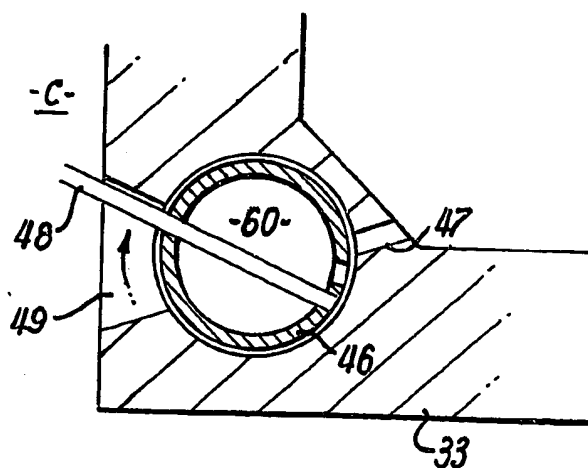
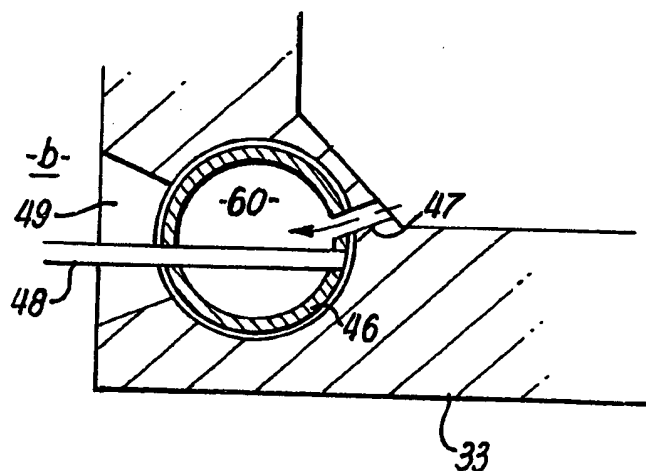
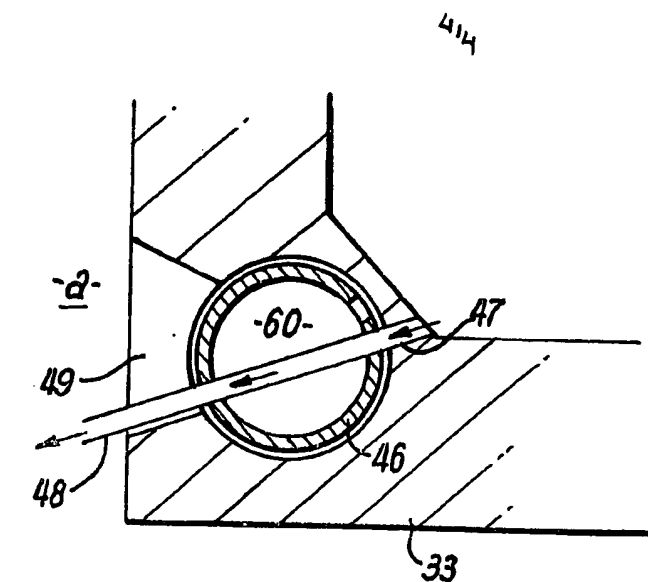


**Fig. 3**

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**FIG. 8**

## SPECIFICATION

## Filter elements for filter presses

5 This invention relates to a filter element for a filter press of the type wherein filtration is performed by a cloth or sheet suspended upon a support adapted to facilitate drainage of filtrate passing through the cloth or sheet.

10 According to the present invention a filter press element comprises a lattice comprising a pair of opposed structures, apertures being provided in each structure, the structures being separated by a web the thickness of the web being less than one  
15 third of that of the lattice.

The web preferably makes a minimal contribution to the strength of the lattice, the strength being provided by the opposed structures. This serves to minimise the weight of the apparatus in contrast to  
20 prior art filter press elements having a thick central plate with drainage ridges on each surface.

The web preferably serves to prevent or restrict flow of liquid between the said structures.

Filtration apparatus in accordance with this invention has the advantage that plastics filter elements especially of polypropylene may be manufactured by injection moulding. Conventional filter elements are too thick and heavy to be injection moulded. The lattice structures of this invention may be composed  
25 of members having sufficiently thin cross-sections to facilitate injection moulding, particularly if the opposed structures of the lattice are moulded separately. The halves may be joined together mechanically or by welding. This allows the structure to be  
30 moulded using conventional injection moulding apparatus. The plate may be moulded in two halves divided through the mid point of the web. Moulding in two halves allows convenient formation of internal parts within the filter element.

40 It is preferred that the thickness of the web is less than one fifth of the thickness of the lattice, more preferably less than one tenth of the thickness of the lattice.

The web may have a thickness less than 5mm preferably more than 0.5mm. A thickness of 2mm is most preferred.

The web may extend across the entire width of the filter plate preventing any passage of filtrate between the said structures. Alternatively, one or more  
50 drainage holes may be provided adjacent the periphery of the plate to facilitate drainage from the structures into outlets which may be provided. A multiplicity of drainage holes may be disposed around the periphery of the web. In embodiments  
55 incorporating a centre feed, drainage holes may be disposed adjacent or around the centre feed.

It is preferred that apertures in each structure are arranged not to coincide with aperture in the opposite structure.

60 In a preferred embodiment of the invention one or both of the structures may comprise an array of parallel members. When both structures comprise arrays of parallel members the arrays may not be parallel to each other, perpendicular disposition  
65 being especially preferred. This enhances the

mechanical strength of the apparatus. However, disposition at any convenient angle may be employed. Parallel arrays may be employed if desired. The parallel member of the two structures may be coincident or non-coincident or staggered as may be convenient.

70 The apparatus may be constructed from suitable materials to utilise the strength of the lattice to allow a maximum reduction in weight and thickness. The need for stay bosses may be eliminated. The reduction in weight is particularly important when large metal lattices are involved, for example of dimensions of 2m x 2m or more, since there are additional economies in the associated support and handling  
80 apparatus.

The lattice may be integral with a surrounding flange section to form: a conventional recess plate for a filter press, a flush plate in a plate and frame filter press, Moore filter leaves, disc filter segments  
85 and elements, or filter press ends.

Separately moulded half portions of the lattice may each be integral with a surrounding and supporting frame or flange.

Preferred filtration apparatus in accordance with this invention may comprise a filter element located within a frame, the frame being openable in use to facilitate removal of the filter element therefrom, and a filter cloth disposed in use against the element within the frame.

95 The frame is preferably adapted to enclose the filter element. The frame may comprise a pair of flanges between which the filter element may be located. The flanges preferably seal the edges of both the filter element and filter cloth.

100 The flanges may be hinged together or secured in any other convenient way. It is preferred that release of the enclosing flanges can be quickly and easily achieved in use to facilitate replacement of the filter cloth.

105 Internal drainage ports for carrying either filtrate from the filter element or wash water to the filter element may be provided. These may comprise coincident channels cast or moulded into coincident inner surfaces of the flanges. Feed inlets or eye outlets may be provided at corners of the flanges or at any convenient alternative location.

Apparatus in accordance with this invention exhibits the advantage that the drainage surface and flanges or other frame may be constructed from different materials. The filter element may be constructed from cast iron, spheroidal graphite, iron, other metal, polypropylene, structured foam polypropylene or other plastics material. The frame may be constructed from any of the aforementioned materials and/or hard rubber and in particular may be constructed from lighter and cheaper materials than those which may be necessary for the drainage section.

125 In a preferred embodiment of this invention a drainage surface of the filter element comprises a replaceable flexible impermeable membrane, the edges of which are secured within the flanges or other frame. The membrane may be inflated from behind to squeeze a filter cake. Sealing of the  
130 periphery of the membrane entirely within the

frame, affords a superior seal to those of prior art in which the membranes are held either with adhesive or mechanically to the external face of the filter plate.

A preferred membrane may be composed of  
5 rubber or polypropylene.

The lattice serves as a support for the membrane.

A flexible membrane may be provided on only one surface of the supporting lattice, the other surface of the lattice bearing a filter cloth as previously described. Alternatively, a flexible membrane may be  
10 provided on both surfaces of a supporting member.

A corner feed filter plate may comprise a flexible membrane sealed by flanges, the latter containing the feed inlet.

15 A centre feed filter plate may comprise a membrane sealed at the feed by any conventional arrangement. Alternatively the membranes may comprise a tubular portion adapted to be received in the centre feed aperture, and two generally planar portions integral with the tubular portion and each adapted to cover a respective surface of the supporting member. Such a membrane has the advantage that it may be located for use or removed for replacement by passage of one planar portion  
20 through the centre feed aperture. The tubular portion may be reinforced to prevent collapse causing blockage of the aperture when the membrane is inflated. Reinforcement of the tubular or planar portions may be achieved by means of cords, wires or cloth embedded in the membrane, in the manner  
25 used in construction of automobile tyres.

A filter cake removal device may be arranged in use to move adjacent the flat surface of the filter cloth to detach a cake of filter residue from the cloth.

30 The apparatus may further comprise a mechanism adapted to move the cake removal device.

The cake removal device may comprise a blade or scraper or wire to detach the cake from the filter cloth. It is preferred that the cake removal device is  
35 sufficiently thin to pass easily through the compacted filtration residue.

A preferred apparatus may comprise a plurality of scrapers, blades or wires, which may be arranged to that each traverses a portion of the filter cloth, thereby rendering it unnecessary for a single blade, scraper or wire to traverse the entire width of the cloth. A single blade scraper or wire or a plurality of blades, scrapers or wires may be disposed perpendicular to the direction of movement in use. Alternatively they may be disposed at an angle less than 90°  
40 to the direction of movement.

Use of a filter cloth upon a filter element which is enclosed and sealed within two separate enclosing flange sections retains the filter cloth in a substantially planar configuration. It also enables the cake removal device to be located entirely within the filter chamber and in contact with the filter cake in its planar configuration. This is not possible with a cloth which is not enclosed (or caulked) and planar.

60 The mechanism for moving the cake removal device across the face of the filter cloth may be activated by or may be part of mechanised filter element separators or moving apparatus which moves each filter element in turn along the filter  
65 sidebars or overhead girder.

Positive cake removal as provided by this aspect enables full automation of a filter press.

Positive cake removal as provided by this aspect also enables thin cake filtration to be practised, thus opening the prospect of vastly improved filtration rates.

Filtration apparatus in accordance with this invention comprising a filter element disposed in a support, may further comprise an internal 3-position valve adapted to control the flow of filtrate from the drainage section. The support may comprise two separate flanges or other frames as previously described. Alternative supports known from the prior art may be employed. A three-way cock  
70 suitable for use with a filter press has been disclosed by Ciba Geigy. However, use of such a cock internally of the support has not been disclosed. Provisions of the cock allows the apparatus to be used for closed filtration in which a series of plates interconnected by a common drainage channel internal of the press and for open filtration in which each plate drains separately into a receptacle or channel external of the press. In the third position the cock is closed.

90 The invention is further described by means of example and not in any limitative sense with reference to the accompanying drawings of which:

Figure 1 is an exploded view of a flush filter plate assembly in accordance with this invention;

95 Figure 2 is a view of a part of the apparatus;

Figure 3 is a cross section on A-A' of Figure 2;

Figures 4 and 5 are cross-sectional views of alternative filter plates;

Figure 6 is an exploded view of filtration apparatus  
100 in accordance with the invention;

Figure 7 is a cross-sectional view of the apparatus; and

Figure 8 shows three cross-sectional views of the stopcock of the apparatus.

105 Figure 1 shows a flush filter plate in accordance with this invention.

The drainage surface 1 comprises a lattice and a peripheral flange. The lattice comprises two perpendicular opposed structures 8, 9 each comprising an array of parallel members separated by a web 10. The array 9 is shown in dotted lines behind the web 10. Alternative arrangements may have the arrays at any convenient angle in non-perpendicular relation.

In further alternative embodiments each opposed structure may comprise a honeycombed-shaped or other configuration of closed cells, the structures being arranged in non-coincident relation on each side of the web 10. A drainage port 11 serves to conduct filtrate through the surround 7. A filter cloth  
115 2 is disposed on the face of the plate. A second filter cloth (not shown) is disposed on the rear face 9 of the filter plate. Backing cloths may be additionally used on both sides of the plate.

The plate may be manufactured from cast iron particularly spheroidal graphite cast iron, aluminium, steel, polypropylene, reinforced or structured foamed polypropylene or any other convenient material.

Figure 2 is a view of part of the drainage surface 1  
130 shown in Figure 1. Figure 3 is a section on A-A' of

Figure 2. The first of the opposed structures comprises an array of parallel members 15 separated by apertures 18. The second opposed structure comprises a perpendicular array of parallel members 16.

- 5 A web 17 separates the structures 15, 16 preventing a flow of liquid from one side of the surface to the other. Alternatively the web may be provided with drainage holes conveniently between each side of the web to allow liquid to flow between the structures. It is preferred that any such drainage holes are located at the periphery of the drainage surface or adjacent a centre feed if present.

The web 17 has a minimum thickness to make the weight of the drainage surface as low as possible.

- 15 The mechanical strength of the drainage surface is provided largely by the members 15 and 16.

The web 17 has a preferred thickness of not more than 5mm, preferably more than 0.5mm. A most preferred thickness is 2mm.

- 20 Figures 4 and 5 show alternative filter plates constructed in accordance with the invention, in which the two arrays of parallel members are disposed parallel to each other. In Figure 4 the members 20, 21 are arranged in staggered or non-coincident juxtaposition. The web 22 is integral with the adjoining portions of the parallel members. It will be appreciated that the separations of adjacent parallel members may be less than the width of the said adjoining portions so that the members overlap on opposite sides of the web.

Figure 5 shows an alternative arrangement in which the parallel members 23 coincide with those 24 on the opposite side of the web 25.

- The apparatus shown in Figures 6 and 7 comprises 35 a filter element 31, a filter cloth 32, an enclosing flange comprising two half portions 33, 34 and a cake removal device 35.

- The filter element 31 comprises a lattice and a peripheral surround 37. The lattice comprises two opposed perpendicular arrays of parallel members 36, 38 disposed on opposite sides of a web 61.

- A drainage port 39 serves to conduct filtrate through periphery of the surround 37. A filter cloth 32 is disposed in contact with one face of the filter element 31. A second filter cloth (not shown) is disposed in contact with the other face of the filter element 31. Backing cloths may be used in addition on both sides.

- The enclosing frame comprises two half portions 50 33, 34 which cooperate in use to enclose the filter element 31 and its associated filter cloths 32. The half-portions 33, 34 may be provided with a sealing ring 40 to prevent leakage of the filtrate. Clamping together of the half portions 33, 34 locks the filter cloth to the filter element. A stopcock 41 may be located in the half-portions 33 and 34 serving to control the delivery of filtrate from the press.

- Arms 42 support and locate the filter element on the side bars of a filter press. A cake removal device 60 35, is located for sliding movement across the filter cloth 32 within the half-portions 34, comprises a plurality of scraper blades 43 each of which is arranged to traverse a portion of the surface of the filter cloth 32. The scraper blades 43 is supported in a casing 44, the latter engaging runners 45 in the

half-portions 34. The scraper 35 may be arranged to traverse the filter cloth 32 upon actuation by the mechanical plate movement mechanism of the filter press. The linkage (not shown) could, for example, be arranged to actuate when the plate movement mechanism is applied to the arms 42. Automatic actuation of the scraper is preferred. Thin cakes of filtration residue may be removed from the apparatus.

- 75 Use of the lattice 36, 38 has an advantage that the parallel members contribute to the strength of the structure. The weight of a metal filter plate may be reduced by one third to a half of that of a conventional metal filter plate, resulting in a considerable saving of materials. Filter plates in accordance with the invention may be manufactured from cast iron, particularly from spheroidal graphite cast iron, aluminium, steel, polypropylene, reinforced or structured foam polypropylene. The use of flanges which are separate from the drainage surface allows the former to be constructed from different materials. Thus polypropylene, structured foam polypropylene, hard rubber or other materials may be employed which are less dense and/or cheaper than those which may be used for the drainage surface.

- Figure 8 illustrates the internal three-way cock of the apparatus. The cock comprises a cylindrical body 46 disposed in an aperture in the two half portions of the separate enclosing flanges 33 and 34. A port 47 serves to conduct filtrate from the drainage surface. A pipe 48 traverses the body 46 and projects from the exterior of the half portions 33 and 34 through a slot 49. In a first position shown in Figure 8a filtrate is conducted through the pipe 48 to the exterior of the press, providing "open" filtration. In the second position, shown in Figure 8b filtrate is conducted into the common drainage eye 60 of the successive separate enclosing flanges 33 and 34 in the filter press. This provides "closed" filtration. In the third position shown in Figure 8c the port from the filter plate is closed.

- The apparatus shown in the drawings comprises only a single eye, containing a three way valve 41. Alternatively embodiments of the invention having filter plate configurations common in the art may comprise two or more eyes in respective corners of the plates. Only one of the eyes would normally contain a three way valve 41. Furthermore, the valve may be employed in a two part filter plate in which the lattice 31 is integral with one of the flanges 8.

#### CLAIMS

1. A filter press element comprising a lattice comprising a pair of opposed structures, apertures being provided in each structure, the structures being separated by a web the thickness of the web being less than one third of that of the lattice.
2. A filter press element as claimed in claim 1, wherein the thickness of the web is less than one fifth of the thickness of the lattice.
3. A filter press element as claimed in claim 2, wherein the thickness of the web is less than one tenth of the thickness of the lattice.
4. A filter press element as claimed in any



preceding claim, wherein apertures in each structure do not coincide with apertures in the opposite structure.

5. A filter press element as claimed in any preceding claim, wherein at least one structure comprises an array of parallel members.

6. A filter press element as claimed in any preceding claim wherein there are one or more drainage holes in the web.

10 7. A filter press element as claimed in claim 6, wherein a multiplicity of drainage holes are located adjacent the periphery of the web.

8. A filter press element as claimed in any of claims 5 to 7, wherein each structure comprises an array of parallel members and wherein the arrays are perpendicular.

9. A filter plate including a filter press element as claimed in any preceding claim, wherein each structure is disposed in a support, the lattice being formed by assembly of two such structures.

10. A filter plate including a filter press element as claimed in any preceding claim, wherein the filter element is located within a frame, the frame being openable in use to facilitate removal of the filter press element, and a filter cloth disposed in use against the element within the frame.

11. A filter plate as claimed in claim 10, wherein a drainage surface of the filter element includes a replaceable flexible impermeable membrane, the edges of the membrane being secured to the frame.

12. A filter plate as claimed in claim 10, wherein a filter cake removal device is arranged to move in use adjacent a flat surface of the filter cloth to detach a cake of filter residue from the cloth.

13. A filter plate as claimed in claim 12, wherein the cake removal device comprises a plurality of scraper blades or wires arranged so that each traverse a portion of the filter cloth in use of the device.

14. A filter plate as claimed in any of claims 9 to 13, wherein a three position valve adapted to control flow of filtrate from the filter press element is disposed internally of the frame.

15. A filter press element substantially as hereinbefore described with reference to Figures 1 to 5 of the accompanying drawings.

16. A filter press substantially as hereinbefore described with reference to Figures 6 to 8 of the accompanying drawings.